PAST, PRESENT, AND FUTURE: REGIONAL PERCEPTIONS OF CANCER AND HOW THEY AFFECT TREATMENT AVAILABILITY

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ABSTRACT

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For my thesis, I will be looking at the history of cancer and its treatments, and the influence of the public's perception about cancer on modern day treatments based on regional differences. The history of cancer involves analyzing when and where cancer was first "discovered" and observed, and how treatments of the illness began. Based on this, different regions of the world have developed different methods for analyzing and treating cancer, potentially based on cultural, social, and technological differences and perspectives. After analyzing and compiling a history of cancer and its treatment, I will analyze how different regions perceive cancer today based on this history and investigate whether these perceptions among different groups were based on a region's infrastructure, or an individual's socioeconomic status, education, and potentially gender in that region.

Next, I analyzed and interpreted how cancer treatments vary in different regions, and whether the difference in treatments was based on the different perceptions among different groups. I hope to also answer the question about why treatments differ based on analysis of these perceptions, affordability, availability and environmental differences. I also wanted to determine if perception of cancer and its treatment among individuals affects compliance to these treatments.

Introduction

Cancer is a treacherous disease that has been around since the beginning of humankind. Although humans have been experiencing its deadly grasp for thousands of years, cancer has still not been officially cured; there is no definitive way to prevent its occurrence. According to the World Health Organization, 18.1 million cases of cancer arose in the world just in 2018, and in the same year, 9.6 million individuals died from the illness ("Latest Global Cancer Data"). One out of every five men and one out of every six women, on average, develop cancer in their lifetime in the world. Each year, cancer is a growing burden that scientists and researchers around the world are fighting to control.

However, scientists have been able to develop treatments and therapies that slow its growth or mostly make it disappear in certain cases. Cancer is a disease that is characterized by somatic cells that divide abnormally and uncontrollably to form tumors. Tumors are large masses of rapidly dividing cells. Tumor cells are also unique in the fact that they usually ignore signals that normally tell cells to undergo apoptosis (or programmed cell death) or senescence (a permanent arrest in cell cycle). Tumor cells can influence healthy cells that form blood vessels and tissues that surround them. The difference between a tumor that is cancerous, called a malignant tumor, and a tumor that is not cancerous, called a benign tumor, is how the tumor moves and affects the rest of the body. Malignant tumors, if not treated or removed early enough, can invade the tissue surrounding it or travel to other parts of the body (a process formally called metastasis) and begin to form malignant tumors there as well. Benign tumors do not invade and travel to different parts of the body and thus can be more easily removed. Although many cancers are caused by malignant tumors, not all are; some cancers, like those that start from blood-forming tissues (leukemias), do not form tumors. There are also many different forms of

cancer depending on the type of tissue the tumor grows in or travels from. Some of the most common cancers across the world are lung cancer, breast cancer, prostate cancer, and ovarian cancer. The treatments used for each type of cancer vary depending on the individual and the unique properties of the individual cancer cells. The three most common forms of treatment are surgery, radiation therapy, and chemotherapy, which will be discussed later.

A reasonable question to ask next is what triggers the rapid growth of cancerous cells. Cancer is a genetic illness; its occurrence stems from mutations that manifest in specific genes that regulate cell division or cell death, either directly or indirectly. A mutation occurs in DNA (deoxyribose nucleic acid), the hereditary molecule of life contained in the nucleus of nearly every cell (except red blood cells, which have no nucleus). The mutation causes damage or mismatch in the DNA structure - the base pairs and the backbone. These mutations can either result naturally or can be induced due to environmental factors that are either physical (i.e. X-rays) or chemical (i.e. alkylating agents) in nature. Scientists have found more than 100 cancer genes in which mutations can fuel the progression of cells to tumorigenesis (Hartwell).. It is thought that most cancers require the accumulation of multiple cancer gene mutations. It is essential to keep in mind that the rate of mutations is low; there is approximately one mutation per hundred million base pairs per gamete (Hartwell). However, environmental factors can speed this background rate of mutation up in individuals.

Moreover, age is a contributing factor because there is a higher chance for mutations to accumulate in older people than in younger people. This background information is vital to understanding what cancer is, how it was discovered, how people think about it, and how it has been treated over the years, up until the present day. In this thesis, I will first be discussing the history of cancer to show how our understanding of cancer has grown tremendously over

centuries, and how treatments arose to mitigate the mysterious illness. This understanding of history will then help me to analyze the regional differences in how individuals perceive cancer affect the procedures that are utilized in those countries, and to compare and contrast different countries around the world.

History

The history of cancer is essential to understanding the disease itself because without documenting its origins and development, researchers would not have been able to learn about the condition and use this knowledge to fight it. Although the incidence of cancer increased recently due to human activities, such as smoking, cancer still attacked individuals for a long time before this. The first record available concerning cancer is from thousands of years ago. In 2014, a skeleton, found by Michaela Binder, a student at Durham University, was the earliest confirmed case of cancer. The skeleton was found at the Amara West site located in northern Sudan and was dated back to approximately 1,200 B.C., nearly three thousand years ago (Ghosh). When the skeleton was discovered, it was observed that the bones were composed of many small holes. This prognosis was indicative of a type of bone cancer. The earliest case of breast cancer was found by a team led by Professor Miguel Cecilio Botella López in 2017. The woman identified with breast cancer was believed to be a part of the ruling class in Egypt because her body was found mummified ("CT Scans of Egyptian Mummies"). The body was dated to be from around 2000 B.C. and was explicitly found in the Qubbet el-Haway in Aswan, Egypt. Computerized tomography (CT) scans were performed on the body to confirm that the woman died from breast cancer ("CT Scans of Egyptian Mummies"). Over the years, researchers have found many more skeletons and remains that provide evidence for humans having cancer for thousands of years, and most documented cases are in Egypt. I think that this is because

much of human civilization started there, where one of the largest and oldest civilizations is located (Mesopotamia), so a higher concentration of humans in Egypt should be expected. Also, at the time that these skeletons were dated to, most modern *Homo sapiens* were still concentrated in Africa and the Middle East, and had not spread across to Europe, Asia, and the Americas. Although many of the skeletons were found in Egypt, there was no correlation to a specific type of cancer in these bodies, so causation is difficult to place as to why Egyptians got cancer.

Although these bones were found relatively recently, before these discoveries, the earliest record of any form of cancer in humans was found written in an ancient Egyptian manuscript known as the Edwin Smith Papyrus. Written around the sixteenth century B.C. (but most likely derived from the original text written in 3000 B.C.), the Papyrus is the oldest record available documenting that humans had the cancer we know today, although the word cancer was never mentioned (Mukherjee). It would be thousands of years until the term cancer was even coined. In the Edwin Smith Papyrus, there are 48 documented cases of wounds and injuries to the spinal cord and skull, each of which has symptoms, diagnoses, and treatments alongside them. Among these health issues documented, signs that closely reflected the symptoms of modern cancer patients (such as multiple tumors throughout the body) were found in the Papyrus as well (Mukherjee). It was most likely written to act as a medical textbook discussing surgery.

Cancer was observed in mummy bones and other fossilized bones, many of them from Egypt, but for thousands of years, there was no name for this terrorizing illness. It was not until the time of Hippocrates, who lived from 460 B.C. to 370 B.C., that a name was given to the disease (Mukherjee). Hippocrates was a Greek physician, known as the father of medicine, who coined the beginning of the word cancer. He used the terms “carcino” and “carcinoma” to describe tumors, which were indicative of cancer. In Greek, both carcino and carcinoma refer to

crab; it is believed that Hippocrates assigned the illness this name because the branching of the tumor from a central mass looks similar to the shape of a crab. A few hundred years later, a Roman physician named Celsus changed the Greek term to the Latin word for crab, which is cancer (Mukherjee).

Historical Treatment Methods

Different methods of cancer treatment were utilized in different parts of the world even though the cause of cancer was not fully understood even after being around for thousands of years. Different regions of the world discovered and practiced various methods of cancer treatment because it is likely that the ideas for how to treat cancer were different and not shared between individuals and doctors from region to region. Ancient Egyptians made a note, in the Papyrus and on other documents, that surgery could be used to remove breast tumors (early forms of mastectomy), but they also realized that this was not a reliable method for eradicating cancer ("Advancement of Cancer Survivorship"). They knew that the illness had a possibility of recurring. In around 1600 B.C., the Egyptians also began to use cauterization to try and remove the cancerous tumors they encountered. For approximately 600 years starting about 1100 B.C, Chinese physicians treated lumps and ulcerations, as written in *The Rites of the Zhou Dynasty.* Around 250 B.C., the *Nei Ching*, also known as the *Yellow Emperor's Classic of Internal Medicine*, was written; it described breast cancer in depth, including its diagnoses, symptoms, and treatments. It also included a full description of tumors and different therapies used to treat them, including diet, acupuncture, and spiritual medicine. In India around 500 B.C., the epic tale known as the Ramayana mentioned using arsenic paste in an attempt to stop tumor growth. In Europe, Hippocrates believed that the body was made of only four bodily fluids, or humors: black bile, yellow bile, blood, and phlegm. This idea was called the humor theory, and it dictated

how cancer was treated for hundreds of years, especially in Europe ("Advancement of Cancer Survivorship"). Because it was against many European religions to cut open the body, diagnoses were made based on visible symptoms and lesions. Based on the humor theory, most physicians agreed with Hippocrates' theory and believed that cancer was due to an excess of black bile in the body (Landau). However, in the eighteenth century, this idea quickly began to shift based on discoveries.

This shift first began to blossom in the fifteenth and sixteenth century, due to the Renaissance movement, which promoted the idea of humanism and stimulated individuals to understand the human body and physiology in depth. In the fifteenth century, one of the influential individuals that contributed to this movement was Leonardo da Vinci. He dissected several bodies to see and understand the human body; his findings were documented in the famous Renaissance Man drawing ("Advancement of Cancer Survivorship"). From this and other dissections performed by various physicians across the world, it was discovered that cancer was not caused by a buildup of black bile, as this black bile was not found in the bodies with cancer. Although the humor theory was debunked, still not much was known about cancer. In the seventeenth century, a French physician named Claude Deshais Gendron believed that surgery was the only way to cure cancer and that all branches and arms of the tumor had to be removed (Hajdu). He did not believe that drugs could improve cancer. He also understood the possibility of metastasis (although the word for this had not yet been created), but argued that if cancer had reached this point, there was no use in any treatment, even surgery. Starting around this time, the importance of early detection for cancer became prominent because many surgeons realized that early diagnosis could allow surgeons to completely rid individuals of cancer ("Advancement of Cancer Survivorship"). However, at this point, surgery was still the primary treatment available

for all types of cancer. For the next two centuries, the development of critical scientific tools, such as the microscope by Anton van Leeuwenhoek, allowed scientists to study cells in high definition. This invention made a significant impact on the future of cancer and its understanding.

After more research was conducted and different scientist began observing cancer, questions were raised as to why cancer begins and what stimulates its growth. Until this point in the eighteenth century, no one knew the cause of cancer. People were only able to observe its effects on the body. One of the first insights into the cause of cancer was developed in the eighteenth century by an Italian physician named Bernadino Ramazzini (Mukherjee). Considered the father of occupational medicine, Ramazzini first observed that there was a low rate of cervical cancer in nuns, but a rather high rate of breast cancer among the same group. Although he did not come up with any significant conclusions other than the speculation that the high rate of breast cancer was due to their celibate lifestyle, it was one of the first instances where the cause of cancer was questioned. His findings eventually led to the idea that lifestyle and hormones could affect the incidence of cancer in individuals (Mukherjee). Another physician named John Hill from London made a similar connection between lifestyle and cancer in 1761 (Hajdu). He observed that indulgence in snuff, a form of tobacco that is crushed and inhaled, was possibly linked to cancer because he encountered six cases in which swellings around the nostrils (i.e. tumors) developed in individuals who frequently snorted snuff. Hill was the first to note that carcinogens could contribute to cancer development and urged people to recognize the harms of tobacco in his report, *Cautions Against the Immoderate Use of Snuff* (Hajdu). Only fourteen years after Hill made his discovery, another London physician named Percival Pott suggested a cause of cancer that originated from the idea Ramazzini had: occupation affected the likelihood

of getting cancer (Mukherjee). He observed that several individuals who worked as chimney sweeps had developed scrotal cancer. Pott believed that the cancer was caused by chimney soot that would collect under the scrotum (Mukherjee). This was another discovery that affirmed that the environment, in this case, chemicals known as carcinogens, could cause cancer directly. At this point, the desire to discover the cause of cancer had begun, amid a time where industrialization and increased pollution was contributing to increased rates of cancer in the population of Europe. In 1740, the first cancer hospital to date was established in France; at this point, the desire to find and treat cancer had become stronger than ever ("Advancement of Cancer Survivorship").

Surgery as treatment

Although surgery had been predominantly used to treat cancer until the 19th century, physicians were interested in finding different means of curing cancer. Throughout history and across the world, different chemicals and herbs were used to curb cancerous growth, but no non-surgical treatment had been agreed upon as an effective treatment for cancer. However, even today, despite the incredible strides made in surgical technology, we know that surgery is still not the perfect solution. For example, in 2011, the survival rate using only surgical methods for patients in the United States with stage IV colon cancer was only about 20% ("Cancer Treatment and Survivorship Facts & Figures"). For female breast cancer patients in the United States in 2014, breast-conserving surgery only had a two percent success rate in patients with late stage breast cancer (Stage III and/or IV) while mastectomies only had a seven percent success rate in patients with late stage breast cancer. The success rate of surgery for cancer treatment increased in these patients when the procedure was used in combination with other treatments, such as radiation therapy or chemotherapy. Similar results were found in patients with non-small cell

lung cancer in 2011. In these patients who had stage III or IV cancer, surgery alone was successful only two percent of the time. However, for patients with early stage non-small cell lung cancer, surgery had a 52 percent success rate ("Cancer Treatment and Survivorship Facts & Figures"). Then, it can be reasonably assumed that before modern technology of cancer treatment was available, the success rate of surgical treatment of any form of cancer in late stages was just as low, or most likely even lower, than the rates reported in 2011 and 2014 throughout history.

Radiation therapy as treatment

It was not until 1895 that the power of radiation was controlled and harnessed to treat cancer. In this year, German professor Wilhelm Conrad Roentgen presented a lecture in which he detailed X-rays he discovered (Markel). This discovery shook the world because of the potential applications of these rays. Within a year after the discovery of an X-ray, physicians began to use it in medicine to treat illnesses. A physician named Emil Grubbe, who hailed from Chicago, was one of the first physicians to put X-rays to the test (Markel). For two weeks, Grubbe decided to create his version of an X-ray, which he tested on his hand. After those two weeks, he developed burns on his hand due to overexposure to these rays. From this observation, Grubbe realized that X-rays had the power to damage tissues and cells significantly. Although it had detrimental effects on his hand, Grubbe wondered how it would affect cancerous cells that needed to be killed to prevent their explosive growth and to limit cancer progression. His first test patient was a woman named Rose Lee, who at 55 years old, had developed breast cancer again deep within her chest wall after a mastectomy. So, Grubbe suggested radiation therapy. Taking precaution to not harm the tissues and organs around the breast, Grubbe placed lead sheets around it to block any X-rays. This process was repeated for several days. However, Lee eventually died from her

cancer. Although this patient did not survive, Grubbe continued to perform radiation on other cancer patients, with a higher success rate over time. He eventually opened an X-ray clinic in Chicago (Markel). After this, radiation began to be used more frequently to treat cancers.

Radiation therapy kills cancerous cells by damaging the DNA, or other macromolecules that compose the cell. In the course of treatment, however, radiation therapy created side effects that were as bad as or even worse than the symptoms of cancer. This led to the exploration of different types of radioactive isotopes and techniques to minimize the adverse effects of the treatment aimed to target cancer. By the 1920s, scientists had realized that fractionated treatment was better than a single dose (Gianfaldoni *et al.*) That is to say, it was beneficial for the patient to get lower doses of the radiation therapy over multiple exposures, rather than to have one long radiation treatment session. Throughout the 1900s, advancements in radiation therapy decreased its danger but also allowed physicians to use the therapy to treat deeper cancers more efficiently. In the seventies and eighties, scientists developed new devices that made radiation therapy more efficient. For example, the use of proton beams became more popular because it was successful in treating tumors and it was easy to control to target specific areas of the body more accurately (Gianfaldoni *et al.*) Nowadays, there are two main types of radiation used: electromagnetic and particulate radiation. Electromagnetic radiation uses X-rays and gamma rays while particulate radiation utilizes electrons, protons, and neutrons. Radiation can also be administered externally or internally, depending on the type and size of the cancer.

Chemotherapy as treatment

Around the same time that radiation therapy was explored, chemotherapy was considered another treatment option that could yield beneficial results. Researchers realized that certain chemicals had the power to treat cancer. This interest in chemical therapy first began in the

1940s ("Evolution of Cancer Treatments: Chemotherapy"). During World War II, mustard gas was used against enemies in warfare because of its ability to create blisters all over the body and in the lungs as it was inhaled. When looking at personnel who had been exposed to the gas, it was found that the gas affected the bone marrow cells in a highly toxic way and significantly decreased their white blood cell count ("Evolution of Cancer Treatments: Chemotherapy"). At the same time, the United States army was studying this gas to find a way to make it more potent in warfare, but also to develop preventative measures to keep the United States' soldiers safe. In the process, two pharmacologists named Alfred Gilman and Louis Goodman discovered a compound known as nitrogen mustard, which worked to cure lymphoma, or cancer of the lymph nodes (DeVita Jr. and Chu). To analyze its effect, they first induced cancer in mice models and treated them with the nitrogen mustard. After this proved to be successful, they injected the nitrogen mustard into a patient with lymphoma. The patient's tumors diminished after multiple injections of nitrogen mustard. The results were published in 1946, and the use of nitrogen mustard to treat lymphomas became a popular form of chemotherapy (DeVita Jr. and Chu). The mechanism behind the compound involved damaging the DNA bases within the cancerous cells, effectively killing them. It became part of a class known as alkylating agents, which all work the same way as nitrogen mustard.

After World War II, physicians and researchers began to look into other chemicals that could potentially work as cancer therapies. A pathologist named Sidney Farber discovered a compound called folic acid, which was crucial in DNA metabolism and had an effect on cancer ("Evolution of Cancer Treatment: Chemotherapy"). He artificially created chemicals that were structurally analogous to the chemical folate (a form of the vitamin B9) but were functionally antagonistic to it. These compounds inhibited the function of enzymes that used folate to be

activated and thus prevented DNA replication. After perfecting the chemicals and the process, Farber administered these chemicals to children who had lymphoblastic leukemia and found that the "antifolates" were able to restore healthy bone marrow in many of the children (DeVita Jr. and Chu; Mukherjee). This drug has undergone a few modifications and is known today as methotrexate, a compound still used in chemotherapies. A few years later, compounds extracted from plants began to be used to help treat leukemia patients (Mukherjee). These compounds were known as Vinca alkaloids, as they came from the plant Vinca rosea, and gained popularity as a chemotherapy in the sixties. Since then, more chemicals, both natural and artificial, have been discovered and created to treat different cancers in the most efficient way possible. In the past few decades, there has been a significant decline in the incidence of cancer-related deaths, due to the preventative measures taken by individuals and the advanced treatments made available to patients.

Only recently have all the various treatments for cancer been used in conjunction to make the most effective treatment plan. These days, it is common for patients to be treated with a combination of the therapies mentioned, known as adjunctive therapy, to eradicate as much cancerous tissue as possible. Usually, for most cancers, after surgery is performed to remove tumors, chemotherapy or radiation therapy is used subsequently to remove any last traces of cancerous cells. Of course, the combination and type of treatments used depend on the individual, the type of cancer, and its progression. Cancer treatment has become a very individualized process, as each person reacts to each treatment differently. The type and efficacy of that treatment also seem to depend on one other environmental factor: the region where individuals with cancer live.

Although many different treatments have been developed over hundreds of years to treat all types of cancer, every country differs in how they approach cancer treatment. Each country differs in policy, availability, and affordability that all influenced the treatment used there. However, this difference may stem from underlying ideas that have developed in the country's population since cancer was first discovered thousands of years ago. Over the years, the people of various regions across the world have formed different perceptions about the importance, prevalence, and dangers of cancer based on the cultural, economic, and social ideals of the area.

Main Question

Different regions of the world are facing the treacherous effects of cancer at different rates and to varying degrees. In some areas, cancer is relatively controllable in most cases due to the availability of treatment and the lack of stigma against the disease. However, some countries and areas are severely threatened by the risk of cancer. The pertinent question at the forefront of this difference is why? Why is it that in one country, people are dying from cancer at alarming rates, and in others, cancer is being treated in astounding ways and more people are surviving than not? To answer this question, I find it beneficial to dive into the different regions and analyze the differences in cancer rates and treatments, and how regional perceptions of cancer might influence these differences. I first want to divide the analysis by country to see if there is a variation in understanding and treatment of cancer within regions as well as between regions, beginning with the broad region of Asia.

Perceptions and Treatments of Cancer: Korea

In Asia, I first want to look at Korea. Although I would like to examine both North and South Korea, more data seem to be openly provided from South Korea; therefore, the information that will be discussed is centered on South Korea. In 2017, Seoul's office of

statistics reported that deaths from cancer had reached an all-time high that year: approximately 80,000 people (Shim). Although it may not seem like much, the death count for cancer accounted for almost 30 percent of all deaths in South Korea. They also found that the most common and fatal forms of cancer were lung, liver, stomach and pancreatic cancer (Shim). Although these statistics seem alarming at first, it is essential to remember the demographic context of the country. South Korea's population is growing increasingly older over the years. Because cancer most commonly occurs in older individuals, and since South Korea has an increasingly aging population, it makes sense that cancer deaths account for such a large portion of total deaths in the country. So, what does this mean for how people in South Korea perceive cancer? Is it a significant concern for them? Moreover, if so, this may lead to different treatments being offered for cancer patients in the region, compared to the other areas.

Because the increase in cancer incidence is more closely correlated with the aging population of the country, rather than potential environmental and lifestyle changes among the Korean community, it would seem plausible that the majority of the Korean people would not have significant concerns or fears about the chance of developing cancer. However, a study conducted in 2014 surveyed 1,009 individuals through random sampling and found that the majority (59.5%) of people surveyed thought that they had a chance of developing cancer at some point in their life (Kye *et al.*) Another study, which was conducted in Korea in 2015 and surveyed 2,000 individuals with a history of cancer, found that only 19% of people had an accurate perception of the rate of cancer incidence (Kim, Soyeun *et al*.) About 50% of these people surveyed overestimated the survival rate for cancers that typically yield low survival rates, such as lung and liver cancers. These statistics showed that the Korean population was

relatively unaware of the incidence of cancer in their country, and this unfamiliarity might, therefore, contribute to the type of cancer treatments available to the population.

Certain demographic groups were also inclined to perceive cancer as a higher risk than other groups. Among these groups were females, younger people, individuals of lower income, and those with a history of cancer in their families (Kye *et al.*) These groups would make sense. For one, breast cancer is a form of cancer that is fairly common among women, and more rare among men, so it is plausible that the women surveyed had breast cancer in mind when responding to the survey. Young people also were able to perceive higher risk likely because they have more access to educational opportunities and are more aware of health risks. Put together, these two factors help to explain that only 30% of women knew that advanced age was a risk factor for developing breast cancer, and older women were less able to identify risk factors correctly (Kye *et al.*) Although women are generally more aware of the risk of cancer than men, the inclusion of older age might affect their awareness of developing cancer. Additionally, people of lower socioeconomic status perceived cancer as a higher risk likely because they experience more stressors in life such as unhealthy diets and environmental pollution among others (Kye *et al.*) Additionally, because people of lower socioeconomic status might have lower education level, they may feel more vulnerable to diseases such as cancer since they have not studied on or learned about the disease factors. What might have been most interesting about this study is that many people used a history of cancer in their family to gauge their risk of cancer; people who did have a family history of cancer were more likely to perceive cancer as a higher risk *(*Kye *et al.)* However, this was interesting because genetics is only one factor that could influence the chance of developing cancer in one's lifetime; environmental factors and lifestyle changes and habits are much more influential on an individual's likelihood of developing cancer.

This finding showed that the people surveyed, which most accurately represented the larger population of Korea, lacked sufficient knowledge to gauge their risk of developing cancer in their life correctly. Another interesting finding was that many people surveyed cited bad luck as a cause of cancer, which suggests an influence of faith and culture on their perceptions of cancer. It seems that many Koreans strongly believe in the power of luck on affecting their lives. The study also found that people who indulged in a healthier lifestyle, including regulated diet and exercise, were more aware of the risk of cancer (Kye *et al.*). After learning that the perceived risk of cancer varied among individuals, primarily based on differences in demographics, it is essential to ask how this affects the treatments offered in Korea and the willingness of the people to seek treatment for cancer. When individuals with cancer are more aware of the risk factors of cancer, it may lead to patients being more mobilized to get treatment, and in turn, to the government having greater initiative to invest in healthcare directed at treating cancer.

Based on the previous research (Kye *et al.*), it seems that Koreans have a relatively good perception of cancer and most of its risk factors. Many Koreans acknowledged the importance of incorporating physical activity and a good diet on decreasing the risk of cancer, so Korean individuals with higher education were more predisposed to take an active role in controlling their lifestyle and participating in physical exercise. Those individuals with higher education and socioeconomic status were also more likely to have a healthier diet because they could afford it, and they tended to work out more often than those with lower education and lower economic status. Therefore, they did not perceive cancer as great of a risk as those with lower financial status and education. Those with a higher education level and socioeconomic status had a good idea about the importance of incorporating physical activity and maintaining good health on decreasing the risk of cancer; however, this still did not translate into the development of more

effective treatments in Korea. Even though the incidence of these various cancers was increasing, and many individuals were aware of the risk factors for developing cancer and their risks based on their economic and educational status, surprisingly, these two facts enough did not translate into their willingness to aid in the treatment of cancer in the clinical setting.

Clinical trials are a significant benefit in the progress of treating cancer by allowing scientists and researchers to test and manipulate different anti-cancer drugs and treatments and to analyze the results so that they can become more effective for patients. However, despite many Koreans knowing this, it did not make a significant difference on the willingness of Korean cancer patients to contribute to clinical trials. In a study conducted by Le *et al*. in 2012, researchers examined the perception of Koreans on participating in clinical trials. In the study, 1000 patients with gastrointestinal/hepatobiliary cancer who visited the Samsung Medical Center in Korea were asked to participate in a clinical study for their specific cancer. Out of these 1000 patients, only 675 gave their consent to participate. However, many of the patients were aware of the potential benefits of clinical trials. Lee *et al.* found that patients with a higher level of education and a higher socioeconomic status were more aware of the benefits of clinical trials than patients with a lower educational level and socioeconomic status. However, in the end, when the patients were asked to participate, factors that ended up translating into participation in the trial were recommendations from physicians, limited treatment options, and the potential of new anti-cancer drugs. In short, higher socioeconomic status and higher education did not necessarily correlate with greater willingness to participate in clinical trials. Even though the cancer incidence is increasing in Korea, and subsequently, the number of clinical trials to help combat the disease also increases, many people diagnosed with cancer are not willing to help further research through participating in cancer trials in Korea. On a scale called the Visual

Analogue Scale (VAS), the score that measures willingness to participate in clinical studies was a 5 for Korea; in comparison, many Western countries ranked higher than a 5 (*Lee et al.*) Perhaps, the lack of willingness to participate in clinical trials is preventing Korean cancer centers and researchers from furthering their studies and acquiring more information to combat cancer. As long as the willingness to participate in trials is not the majority, the incidence of cancer in Korea may increase steadily until the older population becomes more aware of cancer risk factors and clinical trials have enough willing participants to test potentially beneficial treatments. The question is, now, how that unwillingness of cancer patients to participate in clinical trials, despite their awareness of the risks for cancer, influences the treatments used in hospitals and cancer centers in Korea.

Luckily, for Korea, their lack of willingness to participate in clinical trials did not majorly affect treatments available. A study conducted in 2017 by Kim and Yi surveyed 17 major cancer centers across the country to analyze their efficiency and efficacy for treating cancer. Twelve of the centers were national cancer centers, and the other five were major hospitals. According to the study, the number of cancer patients in Korea is increasing, largely due to the increasingly aging population of Korea. Also, it is reported that the number of long-term (five year) cancer survivors is increasing as well due to better detection and treatment methods and more frequent early screening for the disease (Kim and Yi). This means that the rise in the cancer incidence is most likely attributable to changing demographics of the Korean population, rather than lifestyle and diet changes. Having a larger elderly population allows for a higher percentage of cancer incidence in the population since cancer is more prevalent in people over 60. The problem with this is that most individuals (of all ages) surveyed did not recognize the importance of age as a risk factor for cancer even though this is the demographic group that is contributing the most to

the increasing cancer rate. Despite having better detection methods, if the elderly population is not aware of cancer and their risk factors, they will not be diagnosed as often as they should, and the rate of cancer incidence will continue to rise. I want to look into whether the elderly Korean population with cancer affects how cancer treatment is given, or if mainly younger individuals take advantage of the treatments offered since they are more aware of the risks of cancer than the elderly population. One of the central premises of many Korean cancer centers today is that prevention strategy and recovery methods besides the drugs themselves can improve the patient's response to the cancer treatments.

Many of the cancer centers in Korea focus heavily on recovery methods, which are applied generally to cancer patients, in addition to the actual treatments. For one, many of the cancer centers and hospitals offered physical activity programs, while some did not; interestingly, the highest frequency of these programs was found in the regional cancer centers, rather than in the major hospitals (Kim and Yi). This showed that Korea's focus when creating the cancer centers and hospitals was to distribute equal resources throughout the country, rather than to focus treatment efforts in just the urban areas. It also showed that Korea sought to emphasize recovery in patients, since physical therapy after treatment likely allows patients to recover faster and better. This is important especially in the elderly population, in which recovery from gruesome treatments like chemotherapy and surgery is much more difficult. These centers also allowed Korean cancer patients in almost all parts of Korea to have access to proper treatment and recovery options. Many of the centers offered education programs to help Korean patients and non-patients become aware of the growing prevalence of cancer in the country, and to hopefully push Koreans to take more preventative actions to decrease their risk for cancer. It worked. Three different studies conducted by Mahon in 2000, Shin and Lee in 2003, and Li *et al.*

in 2013, all reported that health was managed better in the groups that participated in education programs about cancer prevention, pain was lower in groups that underwent pain education programs, and those that participated in education programs concerning diet, exercise and anxiety management before their surgical procedures reported better qualities of life after the procedures. This was all measured in comparison against a control group that did not engage in any programs (Kim and Yi). After looking at this, although the incidence of cancer is increasing in the Korean population, it appears that Korea is slowly but surely making its way to help patients manage their disease better. The recovery options available at such major cancer centers throughout the country ensured that every cancer patient had nearly equal opportunities to get high-quality treatment and receive education about cancer management. However, there are still two major problems. Even though the centers have helpful resources (especially for the elderly) like post-treatment therapies, these resources are not being utilized effectively by the elderly who need them the most, since the elderly are not aware of their higher risk. Also, the lack of willingness for patients to participate in trials shows that many patients are still hesitant to contribute to cancer research and could, in turn, make progress in the treatment slower in Korea compared to other countries that had higher VAS scores. These two factors can be improved through the education programs that are being offered as long as more individuals, including the elderly and least educated individuals, begin to take part in the programs. Education appears to be vital in changing awareness and in turn improving the treatments utilized and those available currently.

Perceptions and Treatments of Cancer: India

After looking at Korea and seeing how cancer perceptions in the population and demographic factors affect the availability and utilization of treatments, the question I want to

answer next is whether or not this same trend is found in other countries in Asia. Looking at India, I want to know if perceptions of cancer and its risks are the same, due to being in the same region, or whether there are differences in perceptions and treatments of cancer even with the vast area of Asia. India is a country where cancer seems to be negatively stigmatized often and, as a result, is not treated as well as in other countries. In my own experience, my mother's aunt had breast cancer when she was in her sixties. However, she lived in a rural part of Central India, where there were not very many resources that she could afford. Because of this, she was not able to fight cancer through radiation, surgery, or chemotherapy and passed away in a painful, cancer-ridden manner. This situation, which I witnessed with my own eyes, made me wonder if many other Indians who suffer from any form of cancer experience a similar situation and what would contribute to the lack of widespread treatment available besides the weak infrastructure.

Perceptions and Treatment of Cancer: Urban India

In 2016, a study conducted by Elangovan and her team looked into how cancer perceptions affected the treatments and willingness of patients to get help in Chennai, India. Chennai, located on the Southeast coast of India, was home to 10,163,000 people in 2016 and was considered a megacity at the time. Approximately one million people in India have cancer each year, and 67.5 out of 100,000 individuals die from the disease. In the study, nearly three thousand patients who were interviewed represented various levels of society and different socioeconomic statuses. Among these patients sampled, 510 were actual cancer patients, 494 were caregivers, 978 were college students, and 999 were participants sampled from the general public. The study also made sure to include participants from both the slum and the non-slum areas. It is important to note, however, that these categories did not necessarily divide into lower and higher socioeconomic status, respectively; for instance, there were participants who were

from the non-slum urban areas and also of lower socioeconomic status. The median age of all the participants was 28 years old, which is a relatively young age, leading to the possibility that the majority of the group would be aware of cancer and its treatment. However, this was not always the case. Over 50% of the respondents (53.5%) believed that radiation therapy entailed an electric shock (which we know is far from the truth) (Elangovan *et al.*) In general, among males, individuals with higher education and socioeconomic status, with personal experience of cancer, and of a younger age were more aware of cancer and its effects. Another shocking fact was that only about half of the individuals surveyed believed that surgery did not cause cancer to spread to other parts of the body. It seemed as if most individuals were unaware of the efficacy of treatments but had a relatively firm understanding of the risks of cancer and its deadliness. For example, 83.5% of respondents knew that cancer was not contagious, and 79.5% knew that it could be cured. Lastly, participants who were 60 years or older had the least awareness (Elangovan *et al*.) This is most likely because during their generation, cancer research and treatment were limited (even less than there was in 2016), so these older participants may not know about the medical advances in cancer treatment that have occurred.

Additionally, one fault for the limited understanding of cancer in general among the Indian population in Chennai, compared to individuals of other countries within and outside of Asia, is the lack of effective programs to educate people about cancer and the lack of communication between patients and doctors. The study states that it is not common for the patients to ask the doctors questions about their illness, and also uncommon for the doctors to discuss the disease beyond the diagnoses out of fear that their patients would not be able to handle the prognosis well. Additionally, there is a lack of early treatment available for all individuals who have cancer, mainly because 75% to 80% of patients seek out treatment when

the disease has already progressed far (Elangovan *et al.*) This makes cancer even harder to treat and is why India should focus more on cancer education and preventative programs. Only about thirty years ago did hospitals in India begin to use the multiple forms of treatment in conjunction with each other to eradicate cancer - in short, the Indian healthcare system was relatively inexperienced with implementing the various forms of treatment and lacked the resources necessary to treat each patient with such individualized treatments. This lag in utilizing multiple forms of treatment must have resulted in part due to the stigmas surrounding cancer that many Indians have. For example, some believed cancer was brought upon by a curse, or it was untreatable, but most importantly, because it was talked about so little, even among doctors, many did not want to seek treatment.

Perceptions and Treatment of Cancer: Rural India

Since causation of the disease was not readily recognized awareness in such a major city in India, where cancer patients have the highest chance of receiving the best form(s) of treatment, I wanted to compare cancer awareness between Chennai and a rural city in India (much like the place where my great-aunt lived and passed), in order to see if there was a stark difference in how these patients were treated based on their perceptions about cancer. In a study conducted in 2014, Rai *et al.* looked at women in a rural city called Varanasi (home to over 3.6 million individuals) and aimed to investigate their perceptions about cervical and breast cancer, which are two common forms of cancer among Indian females. The 700 female participants in the study were patients who were just recently diagnosed with either cervix or breast cancer and who were receiving treatment at Sir Sundarlal Hospital. Because the study was conducted in a more rural area of India, a majority of the patients were illiterate (59.7%), and only 4.3% of the participants had received a degree. 87.7% of the women were housewives. In terms of the

awareness of cancer, the results Rai and her team found were astonishing, but not surprising. 97.3% of the women did not know the cause of cancer and many of them believed that microorganisms could cause the disease (about 40%). I assume that the definition of microorganisms, in this case, does not include viruses since they can be considered abiotic. The most interesting aspect of the study was the faith in religion that most of the patients had; 58.8% of the Indian females believed that a supernatural factor caused their illness, and 85.4% thought their cancer was an effect of a curse from God. Lastly, 71.3% of individuals consulted a religious counselor to help with their illness (Rai *et al*.) All these facts suggest that a majority of these women living in Varanasi in rural areas have great faith in God and think that God rules many aspects of their lives, including illnesses, in their eyes. Therefore, it is plausible that they do not turn to traditional medicine or have faith in it, because they have stronger faith in prayer to God to help alleviate their cancer. This may be a fundamental factor that explains why there are not many Indian women seeking out medical help for their treatment. The study showed that women only sought out formal medical advice from doctors when the cancer was causing severe damage or pain. This was similar to Chennai, where the majority of individuals waited until their cancer had progressed too far, leading to the high levels of cancer in late stages and difficulties in treatment. Their perception of cancer led people of both rural and urban India to turn to religious help first (due to their massive faith in God) before turning to medical professionals to accurately diagnose them. Their belief in religion over science may reflect the lack of education that is prevalent among Indian women, because they are unaware that cancer arises from biological processes, rather than chance through religion. Therefore, lack of knowledge and communication have slowed down cancer treatment in India, which needs to spend more on resources to educate

the public. Moreover, low availability and affordability of cancer treatment could have augmented the stigmas and misconceptions of cancer in India.

Perceptions in India seem to have a profound impact on the treatments that are utilized or the willingness of patients to receive treatment for cancer. These perceptions are most likely molded by the culture and society in which they grew up. Indians who grew up in more rural areas, like Varanasi, are more likely to be less aware of the causes of and treatments for cancer than those who lived in an urban setting like Chennai. Because of this, they are not able to identify their cancer early on for effective treatment and are less likely to be able to afford the multiple treatments that become necessary as cancer progresses further without intervention. Also, because many Indian cancer patients believe so vehemently in God and are convinced that God has cursed them with cancer, they are more likely to leave their treatment and wellbeing in God's hands, rather than to seek out treatment from a hospital.

Approximately two-thirds of all Indian cancer patients die from the illness (Gulia *et al.*) This leads to a mortality-to-incidence ratio of 0.68, which is much higher than the ratio found in other developed countries, where the average ratio is 0.38. In urban areas, where more Indians are better educated than in rural areas, there is greater awareness about cancer, especially in the younger generation. As more people have degrees and are of a slightly higher socioeconomic status than those in rural cities, urban Indians have a greater awareness of cancer development and progression, as well as its treatment options. However, despite living in a metropolitan area over a rural area, there are still misconceptions centered around cancer, as seen with the high rate of the misconception that radiation therapy encompassed electric shock. This is likely due to the lack of comprehensive treatments available in India in general. Being a relatively impoverished country, India does not have much of the resources and money to offer cancer treatments to all

regions of the country equally (especially being such a large and diverse country). As a result, as mentioned earlier, combined treatments for cancer have only been around for thirty years, and they were most likely only affordable to and utilized by the higher classes. Also, there is a shortage of doctors specialized in cancer, or oncologists, for the number of Indian individuals who get cancer. There is only one oncologist in India for every 2,000 people who have cancer and only a total of approximately 1,000 trained oncologists in all of India (Gulia *et al.*) This means that anticancer therapies are not delivered effectively to all patients, and also contributes to the lack of distribution of equal resources for combatting cancer throughout India. The lack of money and resources, which include trained specialists who know how to administer these treatments, can potentially be attributed to the low education levels among the Indian cancer population, especially in rural areas.

One factor that could significantly improve the cancer survival rate in India would be the implementation of education programs, like those available in the Korean cancer centers, that would serve to educate Indians, both patients and non-patients, about the risk factors for cancer. This might push Indians to seek out help for their cancer earlier on, rather than to wait until the disease has progressed too far. As we have seen, Koreans on average tend to have higher awareness about cancer and its effects, as well as the treatments available. This can likely be attributed to the frequency of high-quality cancer centers and hospitals distributed throughout Korea in both rural and urban areas, as well as the lack of strong influence of religion in their awareness of what cancer is, how it arises, and how it is treated. Additionally, education programs might help Indian cancer patients to manage their health better, as it was reported in many Korean cancer patients who attended the cancer centers with post-recovery treatment recovery options. Hopefully in future years, Indian governments will place more money in

improving the quality of treatments in hospitals throughout the country, as well as in investing money into educating the people of India about cancer and its risk factors to reduce the stigmas against cancer that prevent effective treatment.

In Asia, East and Southern regions showed a stark difference in how individuals in each country perceived many factors about cancer, including its risk factors, causation, and treatment methods. In India, the people, both patients and non-patients, were more unaware of cancer than those in Korea. However, in Korea, there was still the elderly population that was less aware of the cause and treatment of cancer than the rest of the population. The younger individuals knew that cancer was treatable and that environmental factors influenced the cancer incidence in their country. Overall, Korea was also left in a better position in terms of treatment because clinical trials were being conducted in the country (although many Koreans did not want to participate) and their hospitals and cancer centers were more technologically advanced than the hospitals in India. Subsequently, they were able to educate Korean patients about the risk factors for cancer and to facilitate their road to recovery. The cancer centers and hospitals also worked to ensure that treatment was available to both rural and urban regions and that the general public was educated about the cancer incidence through their education programs. India had very little of this available; on top of lacking in technology and treatments open to the general public, little to no effort was made by the Indian government to educate the Indian public, leaving them in the dark about cancer, and possibly contributing to the cycle of Indians not willing to come forth to get a diagnosis or treatment until it was too late. Moving westward, Africa is a continent that has over 1.2 billion people, over one-eighth of the world's population. Looking at this region, based on the infrastructure of the majority of the countries that make up the region, I predict that

perceptions of cancer will be inaccurate in a majority of African individuals, much like what we observed in India, and this in turn will likely affect the treatments that are offered to the public.

Perceptions and Treatment of Cancer: South Africa

Cape Town, South Africa is one of the most developed cities in South Africa, so one might assume that individuals might be more aware of cancer with regards to its risk factors and the treatments offered. In a study conducted in 2010, Maghboeba Mosavel decided to look into how mothers and their daughters living in Cape Town, South Africa perceived cancer and how their perception was influenced by their diverse cultures of Western, African, and Easter origins. The study involved 157 mothers and their 157 daughters (All subjects were mothers with one daughter), and the results were surprising. They found that when the mothers heard the word "cancer", an overwhelming 69% immediately thought of death, and 43% of them immediately also thought of the negative consequences of having cancer, such as losing the ability to take care of and support their family. On the other hand, a fewer proportion of daughters (although not by much) had the same reaction to the word "cancer"; 50% also thought of death when they heard the word and 42% also thought of the adverse effects of having cancer. However, a majority of the daughters studied (66%) stated that their mothers had never talked to them about cancer or had never even mentioned the word to them. A small percentage of the daughters also claimed they did not know what cancer was. From these statistics, it is clear that South African women and daughters are fearful of cancer; it is something not commonly discussed or acknowledged out of this fear. This is partially due to their misconception that the illness cannot usually be treated but instead often results in death. Only 24% of the mothers recognized that if the cancer was discovered early enough, then it could be cured, but that if it were too late, the result would be death. This means that approximately 76% of the mothers sampled did not

believe in any treatability of the illness beyond the early stage, contributing to their fear of it. One positive aspect of the study was that a small percentage of the mothers (11%) thought that if individuals followed a healthy lifestyle and regularly attended checkups with a doctor, they could prevent cancer from worsening (Mosavel) Although this percentage is small, it shows that there are individuals who have realistic perceptions of cancer and its fate. This means that there is hope in improving the knowledge of cancer among South Africans through education at both familial and governmental levels. From our understanding of these perceptions, we can see how cultural beliefs that perpetuate throughout the South African community influence perceptions of cancer.

I am convinced that through communication and greater education, the accuracy of cancer perceptions among mothers and daughters throughout South Africa can increase as they become more aware of the truth behind cancer. The relationship between mothers and daughters could be used as an essential tool for educating future generations on the reality of cancer. From the study, we saw that the daughters had a slightly more accurate perception of cancer than their mothers, and this generational difference and familial connection could be used to educate the mothers about cancer. 80% of daughters studied showed a willingness to talk to their mothers about the benefits of a Pap smear (Mosavel). If South African mothers took advantage of this screening through their relationship with their daughters, it might improve the outcome of many South African women with cervical cancer and may push them to seek out screening and help earlier. This is extremely important in South Africa because the country has free resources available to women to screen for cancer. For women who are thirty years of age or older, pap smears are freely offered to them to test for cervical cancer. However, even though this initiative is already implemented, the fear mothers have of cancer is preventing them from seeking out

early diagnoses. This fear stems from also witnessing in their community other women and men who have cancer, and these negative experiences affect these women more than the benefits of early diagnosis and treatment (Mosavel). The positive effects of early screening and routine checkups for South African women should be made more visible through education and communication to offset the unnecessary fears that can interfere with early diagnosis and treatment. This could be done by visiting a doctor regularly, as well as learning how to examine their bodies. Just as in India, education programs implemented by the government throughout the country and other parts of Africa could be extremely beneficial in adjusting the common misconceptions many women, men, and children have about cancer and may serve to mobilize masses to get help early on before it gets too late. This could, in turn, over generations, help to mitigate the fear of cancer once they see the benefits of early diagnoses and regular check-ups for themselves, their families, and their communities. One interesting factor was that a small portion of the women in the study correctly recognized that cancer was a genetic illness and that a healthy lifestyle could decrease their chances of getting cancer (Mosavel). Many of the daughters cited drinking and smoking as being significant factors in increasing the risk of cancer in South African individuals. Women's organizations that promote awareness of cancer could be incentivized to enhance communication among more women. However, as for now, it seems as if fear is ingrained in the perception of cancer, at least for most women, and this fear is being handed down like genes from mother to daughters, perpetuating misconceptions about cancer and preventing women, and potentially their daughters, from being brave enough to seek out help early on, even though treatment and early screening are available to them.

Although pap smears are available for free for South African women, this does not necessarily translate into complete care and treatment for cancer in African individuals once they

are diagnosed. It is known that many individuals in South Africa are not willing to get screened due to the fear of being diagnosed with cancer, but what does this mean for the individuals who have been tested or diagnosed with cancer? How do they go about treating it? It is possible that the perception of cancer, coupled with the economic situation of the country, influences the treatments available for cancer patients and their ability to obtain complete treatment that would eradicate their cancer. It is important to remember that in South Africa, from the study conducted by Mosavel, mothers and daughters had some awareness about cancer and the possibilities of screening for early detection of cancer, but in cities and countries that are much less developed than Cape Town and South Africa, respectively, the opportunities for treatment and education are likely more challenging to obtain.

An article from November of 2018 published by *CNN* mentions the difficulties of getting any treatment for cancer in Cape Town, South Africa. The article follows a 31-year old woman named Anne Borg who was living in South Africa and was struggling to find doctors who would diagnose her promptly (Gbadamosi). For many weeks on end, she would have to wait in line at 6 A.M. just for a chance to consult with a doctor who could test her for the possibility of breast cancer at her local government-run hospital. Like Anne Borg, many of the other South Africans she encountered in line were also medically uninsured and could not afford to get insured in their lifetime. In general, Borg discovered that it was hard for many people in Cape Town to afford the multiple tests needed to check for various cancers, and only those who could afford them could get diagnosed privately. This made up a tiny portion of South Africans who had more wealth than the majority of the population. At the public hospital, it was common to observe long lines that were full of many people, sometimes as many as thirty people, waiting to undergo a test or receive a diagnosis for their cancer as well. It took Borg six months to get her diagnoses

from the time she was finally able to meet with a doctor, and by the end of those six months, it was too late: her cancer had progressed to the point that required mastectomy (breast removal surgery). Borg was hopeless that she would ever be able to have the surgery in time, after considering how much time had passed since she first met with the doctor until she received the diagnosis. However, Borg found out about a project called Project Flamingo that would grant her the surgery faster, and two weeks after her meeting with a Project Flamingo member, she was able to get a double mastectomy (Gbadamosi).

Although this article was specific to breast cancer, it is safe to assume that the timeline between diagnoses and treatment would be similar for different kinds of cancer in South Africa because breast cancer was so familiar and could often be treated successfully. At many of the hospitals in Cape Town that offered breast cancer diagnoses and treatment, it would take an average of 8.5 months to receive a cancer diagnosis once individuals had met with their doctors (Gbadamosi). On weekends and holidays, most hospitals and clinics are closed, contributing to the lack of productivity in the hospitals in handling the thousands of patients that come in hopes of getting a diagnosis as soon as possible. However, Project Flamingo wanted to change that. Project Flamingo, which was created by a surgeon Dr. Roodt, aimed to fix the waiting problem that is commonly found in many of these clinics in South Africa. The project recruits surgical professionals and volunteers, and raises funds, all of which help to increase the efficacy by minimizing the timeline between the patient visit, diagnosis, and treatment (Gbadamosi). One way to address the long waiting time is to increase the number of cancer centers to provide better access to all of the individuals who need surgeries or other treatments to survive. Doctors in the program strive to decrease the wait time it takes to find out about a diagnosis for breast cancer specifically to 30 days at the most. However, in regard to the project's success, surgeon Dr.

Sarah Rayne says, “Even in Johannesburg, they fail to reach that target more than 60% of the time” (Gbadamosi). This lack of ability to reach their target speaks more about the state of cancer treatment in South Africa than the efficacy of the project; it tells us that surgery is rarely the simple solution to the bigger problem of cancer.

The goal of Project Flamingo, unfortunately, implies that in many clinics and hospitals, surgery is the main, and sometimes only treatment used to manage cancer, especially breast cancer, which is commonly treated with mastectomies. One of the most shocking facts in the article is that only five or six centers in all of South Africa offer chemotherapy and half of the radiation therapy equipment in all of Africa is located in South Africa (Gbadamosi). This clearly demonstrates low accessibility and availability of treatments throughout all of Africa because if the two largest cities (Johannesburg and Cape Town) in South Africa, and some of the most technologically advanced cities in all of Africa, are struggling to provide chemotherapy and radiation therapy, there would definitely not be enough resources to deliver these treatments in other countries that are much more rural and underdeveloped. Even though other African countries and cities may have surgery available in some of the hospitals, multimodal therapies are more effective in treating many cancers. Expedited steps in the process that lead up to surgery or any other treatment is critical in South Africa, but alternative treatment methods need to be made more accessible for people with advanced stages of cancer to increase the survival rate.

As we move to more rural areas, the problem of inadequate cancer treatment gets worse. As was seen with India, many hospitals in Africa are short staffed, especially in rural regions of Africa, and these hospitals face the same problem of having few specialized cancer doctors. In South Africa, there are only six properly trained surgeons for every 100,000 people, in contrast

to the United States, where the ratio of surgeons to people is six times that in South Africa (Gbadamosi). Even in other African countries like Nigeria, which has Africa's largest economy, there is only one surgeon for every 100,000 people. The saddening ratio only decreases further as we move to more rural, underdeveloped countries. In Chad, there is one trained surgeon for every 1,000,000 people (Gbadamosi). Project Flamingo addresses this problem by having a team of surgeons and volunteers with the same goal of offering efficient care, but more programs like it need to become mobilized to help decrease cancer incidence in the more rural, underdeveloped countries across Africa.

It is clear that perceptions in Africa about cancer are generally inaccurate, and only become more misconstrued as one moves to more rural regions of Africa, and the lack of efficient treatment only fuels this fire. These perceptions of cancer are due to fear of the diagnosis, which ultimately prevents many individuals from reaching out and seeking help from medical professionals early enough, as observed in the mothers and daughters surveyed in Cape Town. However, these perceptions are not the only problem. In Africa, because many people are afraid of cancer, they wait too long to go to the doctor, and once they visit the doctor, a relatively long time has passed before patients get their diagnoses back. By this time, many individuals must undergo major surgeries, or may not be helped at all by surgery due to inevitable cancer progression.

Additionally, Africa lacks the resources to treat most cancers holistically, and the problem only worsens as one moves to more rural areas with weaker economies and incapable governments that cannot provide the money and infrastructure necessary to help treat cancer patients sufficiently. One way to address this problem is to start with education and advocacy programs among Africans so that their fear, which stems from misconceptions of cancer, does

not prevent them from seeking out preventative measures that will decrease their chances of developing life-threating cancer. We see the need for public education in shaping the perception and raising awareness of cancer in South Africa as well as in India, two countries with developing infrastructures.

I noticed a difference in cancer perceptions between individuals in underdeveloped and developed countries, which generally affected the treatments that were offered. We saw that Korea was relatively prepared for treating cancer patients, most of whom were well informed about the procedures and outcomes involved in cancer treatment, whereas India and South Africa faced barriers formed by an individual's beliefs or notions that made cancer treatment more difficult. Moreover, in those countries with weaker economies and lower infrastructures, there are limited technologies and resources to support treatment tailored to each patient. Surgery, a treatment most commonly practiced in underdeveloped countries, is not ideal for patients who wait until their cancer is in a later stage. To tackle this problem, the common perceptions about cancer in these countries need to be changed to promote proactive behaviors in terms of taking charge of their diagnosis and treatment early on. This will prevent their cancer from metastasizing to a deadly point and reduce cancer mortality, and can also make treatments more effective and affordable. As mentioned earlier, this is why education programs are essential in improving cancer survival rates in developing countries, as much as advanced and personalized treatments are. Countries with innovative cancer centers and various therapy options, like Korea, Europeans countries, and the United States are better able to take care of cancer patients and, in turn, reinforce an environment in which individuals in the populations are more aware of the risk factors for cancer and have more accurate conceptions of cancer.

Another trend that I noticed between all the regions and countries analyzed so far is the difference between cancer perception in young adults and that in older adults, either women or men. In general, the younger population is more aware of the risk factors for cancer, whereas elderly individuals are less aware and have more misconceptions about cancer. This is most likely due to a technological and educational gap between the generations that have come to experience cancer. In other words, the older generation grew up in a time when many cancer treatment options were not readily available, and these treatment options, like the ones mentioned earlier in the first half of the twentieth century (primitive forms of radiation therapy and chemotherapy), were less effective than the current treatments that are more technologically advanced. Additionally, the older population, who has limited understanding about cancer medicine and treatment, is less willing to participate in screenings and trials that could potentially help themselves or the general public. This leads to increased fear of the illness and unwillingness to visit hospitals for diagnosis and treatment. I suspect that this trend will be consistent throughout most of the regions we look at, especially in places with lower education levels than first-world countries and superpowers. I want to next look at countries that we frequently associate with being technologically advanced, and countries where the history of cancer was well documented and studied and cancer treatment was at the forefront of advancement, beginning with the countries of Europe.

Perceptions and Treatment of Cancer: United Kingdom

The United Kingdom is a first-world country with a traditionally stable economy (although this is changing now) and a well-educated population. Approximately 35% of all people living in the United Kingdom have a degree - about 10% more of the community than the European average ("Average Education Levels"). Additionally, there is a mandate that states that

all children in the United Kingdom must attend full-time education until the age of sixteen. This has resulted in a high proportion of young people who seek a degree from a university ("The British Education System"). The United Kingdom is a relatively industrialized country, but its economy is slowly deteriorating. Although the United Kingdom is more developed than countries like India and Nigeria, the degree of industrialization may not always correlate with that of cancer awareness. Despite the relatively high education level of the United Kingdom, there is still a disparity in education about cancer and its risk factors in the United Kingdom. One study from the British Journal of Cancer gathered data on public perception of cancer among British adults, specifically. The study states that cancer patients in the United Kingdom "tend to present with more advanced disease and have poorer survival rates than many of their European counterparts" (Robb *et al.*) Considering the developed status and the level of education in the United Kingdom, it is curious as to why the effect of cancer is more devastating in the United Kingdom than other countries surrounding it. It is possible that the reason for the more advanced disease presented by many United Kingdom patients is partly due to their education levels, which could affect the course and outcome of treatment by influencing their perception of cancer.

Education levels, which we can assume are usually reflected by socioeconomic status, can have a profound impact on cancer awareness, and this trend is seen among the British population. In the previously mentioned study, 2208 adults were examined to measure knowledge of cancer in Britain. To do this, researchers used a scale known as the cancer awareness measure (CAM) scale, which utilized both open-ended and close-ended questions (Robb *et al.*) The individuals sampled were from different demographic groups, varying in age, ethnicity, education, and occupation. Many different conclusions about people's perception of

cancer in Britain across different demographic groups were drawn following the study. British individuals of lower socioeconomic status and ethnic minorities were more willing to reach out to a doctor to screen for cancer than those of higher socioeconomic status and other ethnicities. Although this is surprising and seems contradictory, many of these individuals cited that they felt that few barriers prevented them from seeking help. These individuals, mainly those of lower socioeconomic status, were found to have more significant emotional barriers (the main barriers cited) than those of higher socioeconomic status. Although restrictions were mentioned, in most cases, these emotional barriers did not always prevent individuals from seeking out professional help. One of these emotional barriers was the fear of the doctor's diagnosis; people in the study claimed that this barrier could prevent them from getting help so that they could avoid finding out the truth, especially if the prognosis was poor. Another barrier to seeking treatment was a busy schedule, which was cited most commonly by people of higher socioeconomic status. However, the same group of individuals with higher socioeconomic status were willing to see a doctor for a cancer diagnosis or check-up sooner rather than later, most likely because they could afford the treatments associated with the diagnosis (Robb *et al.*) This likely correlates with education level; those who can afford the results of diagnosis are those who are more educated about and aware of the benefits of early screening and treatment. We also saw that people of low SES were willing to see a doctor earlier on, most likely because they cannot afford the expensive treatments necessary to treat the disease that has progressed too far, and not necessarily because they are educated about early cancer detection and treatment. Another barrier to seeking treatment was the desire not to waste the doctor's time. Almost 40% of the interviewees, both men and women, revealed that they did not want to waste their doctor's time for a test for cancer or routine check-up, so they would delay visiting a doctor (Robb *et al.*) Additionally, one of the

highest barriers cited was the difficulty of scheduling a doctor's appointment, deterring their desire to check for cancer. Overall, all of these emotional and physical barriers to finding treatment resulted in more considerable delay in visiting the doctor. However, one positive finding came out of the study. Most of the interviewees claimed that they would seek out help from a doctor if they noticed a warning sign of cancer, such as a lump or mole. Researchers also found that individuals who were more aware of the warning signs of cancer were more likely to visit a doctor faster (Robb *et al.*)

In contrast, another concerning aspect of the study was that age had a significant impact on the awareness of cancer of the British population. They found that the oldest age group (those who were over 65 years old) had the most trouble recognizing the warning signs (Robb *et al.*) This creates a problem for decreasing cancer incidence in Britain because most cases of cancer occur in this age group specifically. If individuals in the oldest age group are not able to identify the warning signs, then cancer would progress its course and become difficult to treat. Another interesting age-related factor was that awareness of cancer was lowest in the youngest age group (those around 16-24 years of age) in one aspect: recognition of warning signs. British individuals between 16 and 24 years of age were least able to recognize the warning signs of cancer when presented with different symptoms (Robb *et al.*) This could potentially be because this younger group has not yet experienced cancer as closely as other older individuals have. However, this is still a big problem because it demonstrated that the younger, growing population is not getting enough education about the reality of cancer and its risk factors before they reach an age more vulnerable to the disease.

Even though the United Kingdom is a relatively industrialized, educated country compared to other underdeveloped countries such as those in Africa and India, there is still a lack

of accurate perception about cancer, particularly in the younger and older populations. While some individuals are not motivated to go to the doctor and allow cancer to progress, others cannot even determine the warning signs for the illness. This, in turn, could explain the lower survival rates from cancer and greater progression of cancer in cancer patients in the United Kingdom compared to those in other European countries. One fundamental reform or initiative that could potentially change this reality and reduce misconceptions about cancer throughout the United Kingdom is the implementation of education and advocacy programs. Education programs are critical in making individuals more aware of the reality of cancer and turning fear of cancer into proactive actions for prevention and treatment. As was pointed out in the study, the lack of awareness about cancer is evident in the oldest and youngest populations. They need to know what actions are necessary for treating cancer and improving survival rates. Older people need to be educated about their increased risk for cancer so that they are mobilized to go to the doctor for a diagnosis, especially when they experience warning signs, to prevent cancer from becoming too difficult to treat.

Also, the same education can target the youngest population. Even though so many young people are receiving decent education, they are not well informed enough about cancer to develop realistic and accurate perceptions to prevent or delay the disease. Therefore, education is vital across all demographic groups because it will help individuals across the United Kingdom understand warning signs of cancer and overcome any barrier to seeking early treatment. Instead, visiting the doctor should mitigate their fear because it will allow the British people to take charge of their diagnoses early for better management. It is good to know that the British people of lower socioeconomic status and ethnic minorities are willing to go to the doctor earlier for screening, but this is something that should be reflected in people of all socioeconomic statuses

and ethnicities. As we have seen, education is a reoccurring theme across all countries of different developmental stages and economic growths because it is vital to changing the perception of cancer from unnecessary fear to attainable recovery.

Perceptions of cancer among individuals in the United Kingdom are relatively low for a country with the given economic status and the apparent education level of the people. The delay in visiting the doctor to check for cancer seems to have a profound impact on the survival rates and the severity of the disease in individuals with cancer. The next intriguing question is how United Kingdom hospitals treat their patients who often exhibit advanced stages of cancer. One might think that an economically stable country like the United Kingdom has the resources to treat these individuals and provides access to high quality treatments for cancer. Additionally, many advancements in cancer therapy were developed in Europe, where we expect to find many countries at the forefront of cancer treatment technology. However, if this is the case, why is the survival rate from cancer lower in the United Kingdom than in other European countries? I want to know how the country deals with its cancer patients and ask whether, if at all, the British perceptions of cancer or the efficacy and efficiency of available treatments influence the high cancer rate.

Before we ask if the availability and utilization of treatment in the United Kingdom can explain or correlate with the low survival rate of cancer, it is interesting to point out the British perception on their health care in terms of cancer therapy. A study conducted by Ramers-Verhoeven *et al.* in 2013 looked at different countries across the world and compared their perspectives on cancer treatment and its advancement in their own countries. The United Kingdom was one of the countries where individuals were asked to rate their satisfaction level of cancer treatments. They found that the United Kingdom shared the highest satisfaction levels in

terms of the progress made in cancer treatment over the past 20 years. Many of the United Kingdom individuals interviewed also thought that development in cancer treatment costs much less than it did (estimating around 100 million euros or less), when in fact, the cost of advancement in cancer treatment was in the billions of euros (Ramers-Verhoeven *et al*.) These findings might explain why people living in the United Kingdom still have hope in cancer therapy even though their cancer survival rates are lower than the rest of Europe. Why do patients in the United Kingdom delay their visits to the doctors when they think the country has been making progress in cancer treatment? For one, the fear factor seems to overshadow their faith in the country's ability to fight cancer and causes a delay in seeking help and diagnosing their disease. Additionally, the study found that 70% of the United Kingdom individuals were concerned that progress in cancer development would slow down due to the failing economy of the country (Ramers-Verhoeven *et al*.) Although people of the United Kingdom report high satisfaction levels in progress made in cancer therapy up to now, they fear that the slowing economy of their country would hinder the development of more effective treatments (Ramers-Verhoeven *et al*.) Also, the underestimation of the spending put towards cancer research and development of therapies may reflect their ignorance of the complexities of cancer treatment. Now, I want to know if the United Kingdom's true investment of resources reflects the public's perception of the current status and prospect of cancer therapy.

Contradictory to the highest satisfaction levels in the progress their country has made in terms of cancer treatment development, the United Kingdom actually has one of the lowest shares of its gross domestic product (GDP) spent on health care as of 2014 compared to other countries in Europe. In 2014 specifically, the United Kingdom spent 9.1% of its GDP on health care, but the average amount spent by all other European countries was 10.1% (Davis). We could

interpret this to mean that the United Kingdom spent less on cancer diagnoses and treatment per person compared to other countries. Although the difference in the investment of GDP in healthcare between the United Kingdom and other European countries might not seem much (only about 1% difference), it can explain in part the low survival rates of cancer patients in the United Kingdom compared to other European countries. The GDP that each country spends on health care accounts for all the surgeries, chemotherapies, radiation therapies, and medicines that are needed for cancer treatment; so, when the United Kingdom spends less money on these treatments, the availability and development of cancer treatment for the population will be hindered to contribute to low survival rates. For example, the five-year survival rate for colon cancer was 58% across Europe (on average), but in the United Kingdom, this survival rate was only 52% (Davis). The United Kingdom is also lagging behind other European countries in the "uptake of new cancer drugs," or the willingness to use new drugs developed for cancer therapy (Davis). This can be attributed to the low investment in health care cost and subsequently reduced visibility of new drugs, placing a significant barrier in the development of cancer treatment in the United Kingdom. In addition to educating patients and the general public to reduce their fear and to promote early diagnosis and treatment, the United Kingdom needs to increase spending on cancer treatment as well as development and marketing of new drugs for better results in delaying and ameliorating the course of the disease.

We have seen how individuals representing different demographic groups in the country perceive both cancer and its treatment, and how government efforts and resources can raise public awareness and improve cancer therapy. Next, I want to analyze the relationship between different perceptions of cancer, based on age and the course and cost of treatments. In 2016, there were 1.8 million people who had been diagnosed with cancer in England, and researchers

predict that this number will continue growing each year (Laudicella *et al.*) One study analyzed thousands of patients, over the age of eighteen, who lived with cancer (colorectal, breast, prostate, and lung) in England and estimated the costs involved in their treatment and diagnoses. These costs were obtained from all English cancer registries and hospital databases available. The costs were also then separated into three categories: incidence costs, prevalence costs, and phase of care costs. According to the study, incidence costs are the "costs of delivering care to a homogenous cohort of patients fixed in the year of their diagnosis and followed up for a certain number of years" (Laudicella *et al.*) and only includes those patients who survived from the previous year. A prevalence cost is a snapshot of the total costs delivered to all patients in a calendar year". Lastly, phase of care costs broke up the costs for patients at different stages of care. The researchers then separated these costs for two groups: the younger age group, comprised of individuals aged 18 to 64 years old, and the older age group, comprised of individuals aged 65 years and older (Laudicella *et al.*)

Most of the cancers observed had the highest incidence in the older age group; breast cancer was the only cancer in which the majority of occurrences was found in the younger age group (Laudicella *et al.*) Although cancer incidence was mostly higher in the older age group, patients in the younger age group was more likely to receive cancer treatment in the form of surgery within twelve months of their diagnosis. These patients also had a higher chance of survival after their cancer diagnosis. Prior to diagnosis, the costs for cancer care were higher for patients in the older age group, but this switched during the year of diagnosis. It was shown that the costs for care in the year of diagnosis was 17,241 euros for patients in the younger age group, but 14,776 euros for patients older than 65 in the case of colorectal cancer. For breast cancer, the costs in the year of the diagnosis were 11,109 euros for the younger age group and 7,788 euros

for the older age group. For patients with prostate cancer, in the year of diagnosis, patients in the younger age group spent 5,171 euros, and patients in the older age group spent 4,699 euros. Lastly, for patients with lung cancer, patients in the younger age group spent 12,083 euros in the year of diagnosis, and patients over 65 spent 9,061 euros (Laudicella *et al.*) Although a higher incidence of all these cancers, except breast cancer, was found in the older cohort, the younger spent more on the incidence costs. So, what does this mean?

These statistics reflect what we know about cancer treatment already and make sense: age-based, different perceptions of cancer can affect the treatment course and its outcome. Prior to diagnosis, it is reasonable that the older age group paid more for medical care and check-ups because they are likely to have more frequent visits to the doctors and incur other medical costs for health conditions that are more prevalent with their age. However, the shift to higher costs among the younger age group during the first year of diagnosis can also be explained. As mentioned earlier, the younger age group is more likely to get surgery and potentially other cancer treatments and drugs during the first twelve months after diagnosis; this implies that the cancer care costs for the younger age group will be higher than the costs for the older age group, who receives fewer surgeries and treatments during the initial period. Also, another potential reason could be that some patients in the elderly group cannot afford the treatments, especially if they are retired or if their cancer has progressed too far to benefit from treatment.

Moreover, older patients may be more reluctant to spend much money on themselves when their remaining life is relatively short (whereas younger patients are more invested in recovery). This may also help to explain why the elderly population is relatively unaware of the warning signs of cancer. The elderly may not have many opportunities to learn about the disease and its treatment, or they have another disease that complicates their health and preoccupy their

life. However, the study also found *another* shift after five years in the prevalence costs. Much of the prevalence costs at the five-year mark were attributable to age and were higher in patients older than 65 years of age, except for breast cancer because it is most prevalent in the younger age cohort. This increase in cost in the older group in the fifth year after diagnosis is most likely because younger patients need less care following treatments unlike older patients, especially if the cancer is found at an earlier stage. Younger individuals can potentially bounce back from treatments faster and handle consistent, and sometimes painful, treatments better, decreasing their dependence on the treatments, and in turn, reducing the costs. The group of cancer patients aged 65 and older, however, most likely need to continue cancer treatments among other health-related treatments and expenses, especially if their cancer is more advanced in stage. These costs can accumulate quickly and can potentially explain why their five-year prevalence costs are higher.

Overall, 1.5 billion euros were spent on four cancers (colorectal, breast, prostate, and lung) in Britain in 2010 (Laudicella *et al.*) Despite the difference in age groups and the distribution of cancer costs over time, based on the previous study, it is clear that people of the United Kingdom are not fully aware of the current status of cancer therapy in terms of treatment efficiency (reflected in the cancer survival rate) and innovation (reflected in treatment development). This is why I stress education across the board regardless of the country or demographics of individuals. Education of older populations could help to mobilize them so that cancer does not so quickly reach a deathly stage, which would increase the cost of treatment and care and compromise the quality of life. By educating the elderly, they can get diagnosed and treated earlier for quicker recovery and a longer life span. Education of the younger groups is essential as well so that they do not perpetuate the excessive fear of cancer diagnosis and cancer

costs to future generations, but instead rationally tackle the disease by following effective treatment plans, especially for cancers that are prevalent in younger age groups (e.g. breast cancer). The perception of cancer and its treatment success rate are relatively low in the United Kingdom compared to other European countries, but it would be interesting to make a direct comparison with another country. France is a European country that is advanced economically and technologically, as well as infrastructurally. Do the people of France have different perceptions of cancer and cancer treatment than the people in the United Kingdom, or is the French population more aware of the reality of cancer and its treatment? How does this translate into the cancer therapies that are utilized in the country?

Perceptions and Treatment of Cancer: France

France is an economically sturdy country in Europe, and both France and the United States are considered first-world countries. Still, France is not immune to the effects of cancer; in fact, the cancer incidence of France is even higher than that of the United Kingdom. In France, 344.1 out of every 100,000 people were diagnosed with cancer, whereas in the United Kingdom, 319.2 out of every 100,000 people were diagnosed with cancer in 2018 ("Global Cancer Data by Country"). Interestingly enough, out of the top ten countries with the highest cancer rate, not one of them is from Asia or Africa. As with the United Kingdom (ranking number 13 in cancer incidence), France (ranking number 7 in cancer incidence) also faces a struggle against cancer ("Global Cancer Data by Country"). One might ask if such a high incidence of cancer in France could be attributed to behavioral or environmental factors. A study from 2016 looked at how French individuals perceive cancer and its risk factors and if their perception correlated significantly with socioeconomic status. Common risk factors for cancer were organized into three overarching categories: behavioral, environmental, and psychosocial (Peretti-Watel *et al.*)

Behavioral risk factors included smoking, drinking, and sun exposure, among other actions that humans consciously partake in despite the potentially harmful consequences. The environmental risk factors, such as the chemicals in food and air pollution, were ones that, by and large, individuals had little to no control over. The last group of risk factors was psychosocial factors, such as past traumatic experiences or stress, which affected the minds of participants. After gathering data from 3359 individuals of age 15 up to age 75 (with a 59% participation rate), researchers found that 32.4% of participants thought that cancer was "not avoidable." However, when the researchers controlled for the effect of demographics on the results, such opinion was less frequently held by people who emphasized that certain behavioral factors increased the risk of cancer; they were more likely to think that cancer was avoidable (Peretti-Watel *et al.*) This suggests that some French people recognize that certain behaviors, like drinking and smoking that have adverse effects on health, can increase susceptibility to cancer. Their awareness of behavioral risk factors leads them to think that cancer is partially preventable at will. On the contrary, people who leaned towards the environment as a significant risk factor for cancer more frequently took on the viewpoint that cancer was unavoidable (Peretti-Watel *et al.*) Since environmental factors are more difficult to predict and manage than behavioral factors, people who perceive environmental factors as the major risk factor would be more likely to accept the inevitability of cancer. In terms of socioeconomic status, people with higher socioeconomic status often considered behavioral and psychosocial factors as the major risk factors for cancer, whereas French individuals with intermediate socioeconomic status often regarded environmental factors as the major risk factors. Another exciting find of the study was that many people who emphasized the environment as a significant risk factor admitted to being daily smokers (Peretti-Watel *et al.*) This reflects the idea that people of higher socioeconomic status

tend to think they have better control over their health due to their status. This may be because they can afford better health care or that their work and personal lives are more demanding intellectually in nature. In any case, people who recognize behavioral and psychological factors as the major risk factor would more likely strive to counteract the occurrence of cancer because such factors are more easily found within their locus of control than environmental factors. For French individuals with intermediate socioeconomic status, their financial problems could induce them to view cancer as more intractable and to associate the disease with factors beyond their control. Additionally, because many of these people who emphasized the environment as a risk factor smoked, it could be a sheer denial that their behaviors are worsening their health. As it was the case for the United Kingdom, the French perception of cancer varies with their different socioeconomic status, which, in turn, could affect the rate of cancer incidence.

We could conclude that cultural values were reflected in the perceptions of French individuals especially when demographics were taken out of consideration. Some of the behavioral factors reflect the French culture, and many French participants in the study recognized the influence of these common behaviors on their perceptions of cancer. In general, France has a higher smoking rate than many other European countries. For example, in 2017, 36% of the French population smoked - the second highest rate in all of Europe (second only to Greece) ("Smoking Prevalence by Country 2017"). Drinking is another behavioral factor that is associated with the French culture, and the study suggests that the participants took these behaviors (both drinking and smoking) into consideration when thinking about their perceptions of cancer. Some participants also accepted the notion that psychosocial factors posed a risk for cancer in France. 49.9% of French participants in the study believed that bitterness due to disappointment in professional or personal life could cause cancer (Peretti-Watel *et al.*) This

suggests, once again, that lifestyle choices and cultural values, such as successful and satisfying personal and professional life, shape an individual's awareness of cancer and ultimately affect the public's perception of cancer. Lastly, the study found that youngest respondents believed that behavioral risk factors were the most significant threat (Peretti-Watel *et al.*) Although in reality, risk factors vary in impact, the data suggest that the younger generations are more aware that their actions could influence the incidence of cancer in France. Hopefully, more education among the younger generations about behavioral, psychosocial, and environmental factors related to cancer will decrease the national smoking rate as well as cancer incidence in general. Education programs would help to inform the population about the significant risk factors for cancer and address any misconceptions. Although the French seem to have a pretty good understanding of the contributing factors, their cultural norms could interfere with the implementation of healthy lifestyle choices to prevent cancer. Since smoking is relatively prevalent among the French population, the majority of which recognizes it as a behavior predisposing them to cancer, I want to examine their awareness of cancer, and more specifically, lung cancer.

Wynes *et al.* interviewed 2200 healthy French individuals over the age of 18 on their knowledge of lung cancer, including its etiology, diagnosis, and treatments. 93% of the individuals sampled acknowledged that active tobacco smoking could cause lung cancer, and 67% of them recognized that second-hand smoke could play a role in getting cancer. However, 85% of the people surveyed incorrectly thought that there were noticeable symptoms present for developing lung cancer. Additionally, a majority of individuals recognized chemotherapy, surgery, and smoking cessation as approaches for treating lung cancer. A lower majority (64%) were aware that radiation therapy could be used to treat cancer (Wynes *et al.*) As with the

previous study (Peretti-Watel *et al.*), the numbers from this study suggest that most French individuals are aware of the main risk factors, like smoking, for cancer. However, more public education about the dangers of second-hand smoke could help to reduce the incidence of lung cancer in this country (which has such a high volume of smokers). Additionally, because so few people recognized that early onset of lung cancer had little to no symptoms, education of the masses through schools and public campaigns is essential to advocate early screening and diagnosis. France could improve the survival rate for lung cancer by stressing tobacco smoke as a significant risk factor and by highlighting the benefits of early detection through cancer screeninng.

Given that France is characterized as a country with relatively good awareness about the risks and treatments for cancer, I now want to examine their health care system to analyze its effect on the public perception of cancer. France has some of the most exceptional health care facilities in the world, marked by the outstanding quality of care given to patients at these facilities. As mentioned earlier, France is home to the first cancer hospital, which was established in 1740. Almost three hundred years later, it only makes sense that France is still at the forefront of cancer treatment as it is at the center of Europe, where many developments in cancer therapy occurred throughout history. France has the best overall health care system in the world which can be attributed to requiring mandatory health care and having more doctors per capita than most other European countries ("World Health Organization Assesses the World's Health Systems"). France uses 11.5% of its total GDP on health care, which is well above the European average (10.1%) and the United Kingdom's spending average (9.1%) (World Health Organization). In terms of cancer, they have ten world-renown cancer institutions offering "specialized treatments" for cancer patients ("The Success Rate of Cancer Treatment in

France"). Consistent with the previous statement, the country's major cancer institutes reported a rise in cancer survival rate from 72 to 94 percent over the past twenty years as of 2018. France adopted more modern-day cancer drugs, unlike the United Kingdom, which may contribute to their higher survival rates for cancer than the United Kingdoms. Additionally, most French cancer institutes utilize modern equipment, such as radiation oncology machines, for treatment ("The Success Rate of Cancer Treatment in France"). Overall, France's openness of health care to all individuals and acceptance of advanced therapies may explain why most French cancer patients and non-patients are relatively well aware of the risk factors and treatments of cancer. They may feel more inclined to visit clinics and/or hospitals for screening, thereby delaying the progression of their diseases. Additionally, the French population acknowledges the health risks of certain behaviors perpetuated by cultural values, and thus, their vulnerability to developing the disease (mostly among people of higher socioeconomic status). However, public education that underscores the benefits of early and regular screening and the toxicity of second-hand smoking could still help the French overcome their cultural barriers to restore health and reduce cancer cases. Additionally, as a country at the forefront of cancer technology, France could continue to develop effective drugs with the participation of its cancer patients and share their knowledge with the rest of Europe.

Of all the countries discussed so far, France seems to have dealt with cancer and cancer treatment most adequately in terms of public awareness of cancer and government investment of resources. The perceptions of its people are closest to being accurate, and procedures are holistic, innovative, and accessible. Presumably, their accessible and advanced health care system helps the French know about the latest technologies in cancer therapy and motivates them to seek treatments and join clinical trials. This, in turn, can raise public awareness to overcome fears and

cultural barriers and direct patients toward cancer prevention and treatment. The last country I want to examine is the United States, a melting pot of various cultures and diverse ethnicities. The United States, like France, is also at the forefront of cancer technology, although it stepped foot in the battle against cancer relatively recently in the late 1800s. It has the fifth highest cancer incidence rate in the world - 352.2 people out of 100,000 are diagnosed with cancer at a standard age ("Global Cancer Data by Country"). However, the United States has adopted different technologies and drugs to fight the high incidence of cancer in its population as best as possible. We have seen that educational level is one contributing factor for the public perceptions of cancer. The United States has a slightly lower education rate than the United Kingdom (45.67% and 45.96%, respectively) (Hess). The question is whether this slight disparity translates into similar perceptions of cancer in the two countries, or whether the United States has a better awareness of cancer and its risk factors than the United Kingdom and other countries, and, if so, the underlying reason.

Perceptions and Treatment of Cancer: United States

Different studies have compared the public's perception of cancer between the United States and other countries and between distinct demographic groups in the United States. When six different countries (United Kingdom, Japan, Germany, France, Italy, and the United States) were compared to each other in terms of cancer perceptions, the United States had the smallest proportion of individuals who agreed with the statement that a "cancer diagnosis will ultimately result in death," despite the use of cancer treatments (Ramers-Verhoeven *et al.*) While 65% of the United States participants disagreed with this statement that correlates cancer with inevitable death, 73% of the United States respondents underestimated the cost of cancer treatment development and approximated the cost of 100 million dollars or less. As it was the case with the

United Kingdom, underestimation of the United States' spending in cancer research and drug development could reflect their ignorance of the complexities of cancer treatment, or their lack of trust in government funding. However, a majority of those surveyed are aware that cancer is treatable although the percentage of individuals who associate cancer with death (35%) is relatively high for such a developed country (Ramers-Verhoeven *et al.*) Another study involving United States participants looked more closely at this fear of death associated with cancer in the elderly population. In the study, 454 adults aged 50 and older were surveyed about their willingness to get screened for colorectal cancer (Bynum *et al.*) One positive finding from the study was that only 15% of the respondents indicated their unwillingness to participate in colorectal cancer (CRC) screening. We can extend the result to suggest that most people in the older age group in the United States are willing to screen for cancer. Although many admitted their fear of screening, which could discover late-stage cancer or cause pain from the procedure, a majority of the participants would rather undergo testing to protect their health (Bynum *et al.*) Their awareness of the benefits of cancer screening is consistent with their association of the disease with recovery over death, as shown in the previous study (Ramers-Verhoeven *et al.*)

The United States, in general, has a good grasp on the reality of cancer; they realize that it can potentially be treated to avoid death and that screening, if done early, can be beneficial for managing their illness. It is encouraging to see a high rate of willingness to screen for colorectal cancer in the older age group, which is more susceptible to the disease than the younger age group. In other countries, such as in South Africa and the United Kingdom, we observed that the older generation was generally more fearful of cancer and more reluctant of screening than the younger generation. The lack of such age-dependent variability in perception and attitude in the United States can be ascribed to education. Moreover, despite the ethnic diversity (either African

America, Hispanic American, or White) of participants, there was no significant difference in their perceptions of colorectal cancer and willingness for screening based on ethnicity (Bynum *et al.*) Hence, we can conclude that the United States' understanding of cancer is mostly independent of variance in age or ethnicity, possibly due to general education across the nation.

After looking at perceptions of cancer among individuals from the United States, one might assume that if the United States population is reasonably well informed about cancer and disposed to receive diagnosis and treatment, then they would actively participate in screening and therapy. On the contrary, 39% of the individuals from the colorectal cancer study stated they had never even gotten a colonoscopy (an important test used for colorectal cancer diagnosis) (Bynum *et al.*) However, it is clear that fear levels of cancer diagnosis in the United States are much lower than in other countries, like India and those in Africa. Besides, the United States seems to have a holistic and progressive system for treating cancer patients even though many people speculated the United States spends much less on cancer treatment development than it actually does. In fact, the United States has spent over one billion dollars on cancer treatment development in the past year. I suspect that the United States' health care system and technology can, in part, explain their relatively positive outlook on cancer. On the other hand, a relatively low participation rate in screening such as a colonoscopy may reflect inequality in health care (which is reflected in the various degrees of health insurance coverage) among people of different socioeconomic statuses.

One way to measure the efficiency of health care is by calculating the time to cancer treatment. As seen with South Africa, the timeline between the patient visit, diagnosis, and treatment lasted weeks, if not months, and such delay often caused cancer to progress faster and make treatment more difficult. Longer time to treatment initiation (TTI) could be detrimental in

other aspects, such as stress and anxiety generated as feelings of helplessness increase in patients. In regards to the United States, many health care providers predict that as the health care system increases in complexity, the TTI will increase as well. In a study conducted in 2019, Khorana *et al*. tracked TTI over time, between 2004 and 2013, for the United States patients with early-stage tumors. They found that the median TTI for various cancers was 27 days in the United States (almost seven months shorter than the TTI in South Africa). However, the TTI steadily increased over time, from a median of 21 days in 2004 to a median of 29 days in 2013.

Moreover, it was reported that blacks had a higher TTI than whites, by a difference of 1 to 6.7 days depending on the type of cancer (Khorana *et al*.) This was interesting because the previous study (Bynum *et al*.) suggested that minorities in the United States do not significantly differ in their perceptions of cancer from other ethnicities; but it seems that the treatments utilized could be disproportionate for certain ethnic groups based on the study. Although many different explanations could be posed for why this is the case, no satisfying answer explains this discrepancy. One potential reason could be socioeconomic status, which may affect an individual's affordability of the treatments and in turn their TTI. Additionally, TTI influenced the survival rates for cancer. "Prolonged TTI" (defined as greater than six weeks) decreased survival rate significantly across all cancers except prostate cancer (Khorana *et al.*) However, because the study found that the median time was around 27 days, it suggests that the United States' health care system is currently doing an excellent job of delivering cancer treatments efficiently relative to underdeveloped countries. This could potentially explain the lower fears associated with a cancer diagnosis in the United States. Because the United States is relatively efficient in treating cancer with high-quality treatments such as surgery, chemotherapy, radiation therapy, and multimodal therapies, cancer patients and non-patients are likely to have less to fear

even if their cancer is not caught in a primitive stage. However, if TTI indeed lengthens over time as predicted by health care professionals, then the survival rate is expected to fall, and the United States perception of cancer may not be the same in the future.

Conclusions

The history of cancer in the human race is one that is long and extensive. Even thousands of years ago, individuals were not immune to the fatal grasp of the illness, and it still continues to adversely affect individuals across the world every day. However, it is important to recognize that although all individuals have a chance of being affected with the illness (some more than others due to their lifestyle choices and genes), not all individuals around the world have similar accessibility to and availability of resources. This may stem from the fact that perceptions of cancer vary between and among regions. Some regions are populated by individuals who are relatively unaware of cancer and its risk factors, which we observed in India and South Africa specifically, and others are relatively well educated in cancer risk factors and treatment (France and the United States). These differences in perception, as well as the history of cancer and its treatment in those regions, in turn, influence the treatments that are offered and utilized by cancer patients in those regions. After looking at six countries all around the world (Korea, India, South Africa, United Kingdom, France, and the United States), there are specific measures that, if implemented, could potentially decrease the rate of cancer incidence and increase the rate of cancer survival in every country by improving perceptions of cancer. One of these measures is education, which can be enriched in both underdeveloped and developed countries. The perception of cancer varies within every country by demographic factors and between nations by economic and education levels. However, it is also crucial to remember that not everyone in any given country is aware of the risk factors, causes, and treatments of cancer, and their perception

can influence their own course of disease. Opinions of cancer seem to vary with an individual's socioeconomic status, religion, education level, or ethnicity and it is because of this that I stress the significance of education. Education programs implemented by the government and advocacy programs initiated by the public can help to fix misconceptions of cancer so that fear and misinformation are not limiting an individual's ability to seek out medical help. Much of the population of India and Africa (especially those living in rural areas), and even some individuals of Korea are dictated by fear of their diagnosis and treatments. Especially in places like India and Africa, where advanced therapies like chemotherapy and radiation therapy are infrequent and unaffordable, education is vital in catching cancer early so that it does not progress to a point where the limited treatments they receive no longer prove to be beneficial.

Korea was a good example that demonstrated the potential of clinical trials and research in cancer therapy. Many Korean patients were unwilling to participate in clinical trials despite their awareness of the benefits, and this only proved to be detrimental for cancer research. Clinical trials are vital for testing out new cancer treatments for improved therapy, and the participation of cancer patients is crucial to test the efficacy of drugs. Without their participation, cancer treatment development will be at a standstill, and cancer therapy cannot progress any further. Especially in countries like France and the United States, which are willing to utilize new cancer drugs and therapies, clinical trials help to speed up the process of drug approval and marketing to the public. This is another reason why education of the population is so important. Many individuals fear the consequences of participation in clinical trials, but do not understand the essence and benefits of participation. Education programs across all countries and all regions are essential for perpetuating accurate awareness of cancer. It will allow patients to manage their fear of cancer, to mobilize them to get tested and screened earlier, and to diagnose and treat their

potential disease earlier and more efficiently. This is important especially in countries where the cancer treatments available are not the most advanced, such as South Africa, Nigeria, and India, and so they need to rely on the most basic forms of treatment, such as surgery, which will work best for cancer in the initial stage. Education of such large and diverse populations around the world will take time, but I believe that with time, education will eventually mitigate people's fear of cancer and will encourage them to seek out help and treatment if needed. Every individual deserves the right to take care of their health, and accurate and health perceptions of cancer, as well as appropriate and affordable treatments available in different regions, could eventually diminish death rates and alleviate unnecessary suffering among cancer patients as they are slowly but surely mobilized to get the treatment they need and deserve.

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Biography

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